Polymer Science - Series A 2003 vol.45 N12, pages 1250-1260

Spin-Lattice Relaxation in Polymer Melts

Fenchenko K.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The theory of spin-lattice relaxation is constructed for melts of polymers with Mw values that exceed the critical molecular mass Mc corresponding to the development of entanglements. Analytical expressions for the spin-lattice relaxation rates are derived in terms of the reptation model and within the formalism of renormalized models. The contributions from interactions of various spin groups to the spin-lattice relaxation rate are estimated. The contribution from the interaction of spins involved in the different segments of the same macromolecule is found to be negligibly small compared to contributions from the intrasegmental and intermolecular spin interactions. The experimental data obtained for the melts of PEO with a high molecular mass attest that, in the low-frequency NMR region ω < 10 4 Hz, the contribution from intermolecular spin interactions to the spin-lattice relaxation rate may be as high as 75%.